ORGANIC CHEMISTRY FOR AGRICULTURAL STUDENTS.

Organic Agricultural Chemistry (The Chemistry of Plants and Animals). By Prof. J. S. Chamberlain. Pp. xvii+319. (New York: The Macmillan Co.; London: Macmillan and Co., Ltd., 1916.) Price 7*s.* net.

THIS volume is intended to solve the difficult problem of providing a course in chemistry for students at agricultural colleges. By common consent the ideal plan is for the would-be agricultural chemist to go through the pure chemical course and take an honours degree. But many cannot do this; their training has to be carried out at the agricultural college, where chemistry as such is strictly subordinated to the matter in hand.

Prof. Chamberlain deals with the problems by picking out those substances that the student will come across in his agricultural studies, and then connecting them together by building up the course round them. Necessarily this prevents discussion of many problems of chemical interest; constitutions have to be taken on trust without even an indication of the way in which they have been established. The course, too, is necessarily altered, and many old friends disappear: the ketones are not mentioned; even acetone is not described.

But the book has to be judged by its suitability for the people for whom it was written, and from this point of view it is satisfactory. The ordinary simple substances are dealt with in sufficient detail, and the experiments are numerous enough to ensure that the student shall familiarise himself with them. Fats, sugars, starches, and proteins are discussed in a simple manner, and various interesting illustrations are given that show the bearing of chemistry on the problems of everyday experience.

The first section of the book having dealt with organic substances, the second is devoted to physiology, both of plants and of animals. It is unfortunate that the lecturer in agricultural chemistry is almost always called upon to teach these subjects, for it is obvious that no man can do justice to physiology when he has to bring it in simply as an "extra." Prof. Chamberlain has courageously introduced the chapters, and no doubt they will supply the teacher's needs. But throughout one has the feeling that agricultural chemistry ought not to be extended to include physiology.

The third section treats of crops, which undoubtedly belong to the subject. An account is given of the proximate and ultimate constituents of the ordinary crops, and of their value to both man and animals. The author classifies them on p. 150 as volatile and non-volatile, using "volatile" to include starch, cellulose, protein, etc., and "non-volatile" for the ash constituents. It would have been better to retain the old terms "organic" and "mineral," or something that does not involve calling cellulose a "volatile" substance.

Several omissions call for remedy. In a book of this kind the student may reasonably expect to find the answers to the questions that arise in everyday practice. What, for instance, is the constituent in cotton-seed cake that has such a "binding" effect on cattle? or the substance in young grass that makes them scour? Why is May grass better than October grass? Why have mangolds to be stored some months before they can safely be used? These are the kind of questions about crops that are perpetually before the agricultural instructor in this country, and a similar variety of questions must be put by inquisitive farmers in the States; they represent the kind of problem that the text-book writer ought to face.

The book has several new features which seem decidedly useful. No space is lost in giving details of analytical methods which, as the author truly observes, can be got out of the analytical text-books. The detailed study of animal nutrition is taken before that of plants—a course which, in the author's experience, gives the student a clearer conception of the biochemical changes involved, and at the same time emphasises both the differences between plants and animals and their fundamental similarity.

No references to original papers are given, but there are references to larger text-books, so that the student seeking further information will know where to find it.

The book is, we believe, the only one of its kind. The well-known volume by Haas and Hill was written from the general biochemical point of view. Prof. Chamberlain is, so far as we know, the only recent chemist who has written organic chemistry for agricultural students. E. J. R.

COLOUR.

Color and its Applications. By M. Luckiesh. Pp. xii+357. (London: Constable and Co., Ltd., 1915.) Price 16*s.* net.

IT is always difficult, if not impossible, to separate the principles of a science from the applications of them, and the author has, perhaps wisely, not attempted to do so. On the other hand, while a student may be able to master the principles so far as they have been made clear, he can never hope to become practically acquainted with the innumerable applications of such a subject as colour. Therefore, we have here a very good account of the fundamentals, and a similarly good account of some of the applications, while other of the latter are treated in so limited a manner that it can scarcely be claimed that they are fairly presented. With these few exceptions, which indeed the author from his preface evidently appreciates, we have a very useful general treatise on colour which includes 130 well-selected diagrams, curves, and tables, so that for very many purposes the book will be found sufficient in itself. But at the end of every section references are given to other text-books and to original papers to facilitate a more extended study.

About three-fifths of the volume is devoted to

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fundamental matters: the nature of light, the production of colour, colour mixture, colour terminology, the analysis of colour, colour and vision, the effect of environment on colour, theories of colour-vision, and colour photometry. In connection with colour mixture we have the subtractive and additive methods dealt with, and also the "juxtaposition method" as if it were a third method, though it is this only from a practical point of view, being really a form of the additive method. The mixture of both the subtractive and additive methods which exists in three-colour typographic half-tones is not referred to, but in omitting this the author only follows in the footsteps of those who have preceded him. It seems to be generally taken for granted, perhaps because "subtractive" colours are used, that this is simply a modification of that method, but the most cursory examination of a print will show that the dots of colour, while often more or less superposed, are also often juxtaposed.

A few pages that should be of much interest to those who need to make critical observations of minute detail, as in some microscopical work, deal with acuteness (or "acuity") of vision. For the same brightness in all cases vision is more acute with monochromatic than with white light, and for this purpose yellowish-green is superior to any other colour. The reviewer would observe that microscopists generally prefer this colour, which is also that for which the eye is most sensitive and for which objectives are generally best corrected. But the superior resolving power of light of shorter wave-length has led to the occasional use of bluish-green light, in spite of its obvious disadvantages. It seems from the figures given that the microscopist may lose more by the reduction of his acuteness of vision, even assuming equal brightness, than he can possibly gain by the increase in resolution, unless he can command a higher magnification without introducing other troubles.

With regard to the applications, colour photography is briefly dealt with in eleven pages, but the next group of chapters, "Colour in Lighting," "Colour Effects for the Stage and Displays," and "Colour Phenomena in Painting" (which deals chiefly with questions of illumination), occupies more than a quarter of the whole volume. This is evidently the subject that most interests the author, as, indeed, one would expect from the position that he occupies. Colour-matching as a special art, an account of various attempts to make "colour-music," borrowing more or less the notation of sound-music, and a few notes on coloured media, complete the volume.

C. J.

QUARTIC SURFACES.

Quartic Surfaces with Singular Points. By Prof. C. M. Jessop. Pp. xxxv+198. (Cambridge: At the University Press, 1916.) Price 12*s.* net.

WE have in analytical geometry a great contrast between the general and the particular. For algebraical curves and surfaces of the nth order or class we have a comparatively large number of results, such as those given by Cayley, Cremona, and others half a century ago; but when we take a particular value of n and try to investigate, say, the distinct types of surfaces of that order, the task is a very formidable one if n exceeds 3. The present work deals with the case when $n=4$, and that only so far as relates to surfaces that have nodes or nodal curves, or both.

Chap. i. shows us very simply the forms of equation corresponding to quartics which have from four to sixteen (ordinary) nodes; this gives twenty-four types of surface, some types having further varieties. As we might expect, the sixteen-nodal surface is the easiest one to discuss in detail; practically we have Kummer's surface and particular cases of it, and by introducing theta-functions we can obtain many elegant properties with ease (this is shown in chap. ii.). Among the six-nodal quartics we have Weddle's surface (discussed pp. 173–188); here double theta-functions are useful auxiliaries.

Chap. iii. gives an account of quartics with a nodal conic; when this conic is the imaginary circle at infinity, the surface becomes a cyclide. Prof. Jessop might have remarked that since any two conics in space are projectively equivalent, the theory of cyclides includes that of all quartics with a nodal conic. Hence we may, if we like, read chap. v. (on cyclides) and translate all its theorems into properties of every quartic with a nodal conic, and thus deduce the theorems of chaps. iii. and iv. However, the author's sequence has the advantage of introducing us at an early stage to Segre's wonderful projection of quartics from four-dimensional space (p. 55), and to Geiser's one-one relation between points on a plane and those on a general cubic surface (p. 46). The value of Segre's method becomes still more obvious in chap. iv., which ends with his table of types of quartics with a double conic, arranged according to indices of elementary factors; this is one of the most valuable tables in the book.

Chap. vi. deals with surfaces with a double line, among which Plücker's surface appears; chap. vii. with quartics that contain an infinite number of conics (here Steiner's surface comes in); chap. viii. with rational quartics in general; and chap. ix. with determinant surfaces (Weddle's surface being the symmetric case). All are well worth reading; and, in fact, the treatise has the great merit of introducing us to the main methods which have, in this inquiry, replaced tiresome algebra by a combination of abridged notation, pure geometry, and function-theory suited to the particular problem in hand. Without making any invidious distinctions, we may fairly assert that, in this particular domain, Segre and Humbert have, each in his own way, immensely simplified the discussion of the theory.

Prof. Jessop's book has, of course, the defects of its qualities. Among these we may note that he never points out that in writing a treatise on algebraic loci with certain singularities he is at the same time writing on algebraic envelopes

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